DOCUMENT RESUME

ED 188 246 CS 205 681

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TITLE Anaphoric Relations, Comprehension and Readability.
PUB DATE Sep 79
NOTE 34p.: Paper presented at the Annual International Conference on Processing of Visible Language (2nd, Niagara-on-the Lake, Canada, September 3-7, 1979).

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTCRS Adults: College Students: Higher Education: Language Patterns: *Prcnouns: *Readability: *Reading Achievement: *Reading Comprehension: *Reading Processes: *Reading Research
IDENTIFIERS *Anaphora

ABSTRACT

The relationship between anaphoric nominal substitution and reading comprehension was studied. The Diagnostic Reading Test and the Substitutien Test were administered to 80 college juniers, seniors, and graduate students in teacher certificatien courses, and to 92 ccllege freshmen seeking assistance in improving their reading skills. Positive and significant relationships were found between tctal substitution scores and reading scores for both samples. It was found that anaphoric resolutien was a highly ccmplex ccgnitive-language skill and a factor in reading ccmprehension, explaining approximately 59% cf the variance in reading performance. The process of antecedent-substitute resclutien was not a simple matter of recovering the information from the context. The distance a reader had to backtrack to locate the antecedent and the amcunt of informatien represented by the substitute were found to be good predictors of difficulty in perfcrming the referencing task. Of the four item characteristics investigated, the syntactic variables change and discrepancy were not as powerful as the semantic variables length and distance in explaining item difficulty. Since readability measures have not incorporated anaphoric relatiens as a factor in their assessment, it was recommended that a framewcrk fcr examining the comprehensibility of text would be a valid alternative tc readability formulas when it would be necessary tc evaluate and select materials for specific readers. (RL)

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ANAPHORIC RELATIONS, COMPREHENSION AND READABILITY

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Paper presented at the International Conference on Processing of Visible Language 2, Niagara-on-the-Lake, Canada, September 3-7, 1979.

Using a single sentence as the basic unit of analysis has been a well-established tradition within the linguistic discipline. This tradition is evident in the work put forth by Bloomfield (1933), Fries (1952), and Chomsky (1957). While the analysis of syntactic relationships between and among linguistic units on the sentence level has served these linguists well in theory building, it is inadequate in advancing our understanding of the way people process, and more importantly, comprehend language. In comprehending text, one must go beyond individual sentences and see how the entire structure develops in a given discourse. In shifting from single sentences to connected text, one important question emerges : What binds the sentences together in a text? This question can be most meaningfully explored in the context of the recent advances made in discourse analysis.

Grimes (1975) proposes that the semantic structure of discourse, regardless of languages, has three components. They are content, cohesion, and staging. Of these, cohesion is that which binds the text together into a meaningful unit by relating what is said at the moment to what has already been said. On the surface level, cohesion can be realized through the use of various cohesive ties, namely, lexical cohesion, reference, substitution, ellipsis, and conjunction (Halliday and Hasan, 1976). One such cohesive device, anaphora, is the topic of this paper. Since this conference is about the processing of visible language, I will have the written language as the focus of my discussion. The remarks I will be making, however, may equally apply to the spoken language.

The concept of anaphora can best be introduced by considering the following two passages.

1. In the past years people had been thrown into prison at the whim of the government -- a custom which persists in some countries to the present day. A person so imprisoned could be kept there indefinitely, without any charges being brought against him. Perhaps he had committed no crimes; who could say, since he had been charged with none? Perhaps he was merely a political opponent of the government, or had for some other reasons incurred someone's ill will. The American colonists would have none of <u>this</u>. (Felder, 1970, p. 54)
2. A great majority of those who commit crimes do so impulsively, giving little if any thought to their actions. Perhaps a crime is committed in a fit of anger or as the result of unbearable economic pressure. <u>This</u> of course does not lessen the seriousness of the act, nor does <u>it</u> relieves society of the responsibility to punish the offender. (Felder, 1970, p. 172)

I would like to draw your attention to the pronominals underlined. In every instance, the pronominal refers back to, or is anaphoric to, certain elements already expressed in the text. The pronominal signals to the reader that the information necessary for interpreting the sentences lies elsewhere. On the semantic level, the pronominal <u>this</u> in the first passage refers to the ideas expressed in the preceding context whereas on the syntactic level, it replaces the construction which could be inserted into the position occupied by the pronominal in the sentence. The pronominal <u>this</u> in the second

passage refers to the ideas expressed in the preceding sentences but can only replace the nominalized form of the ideas to which it refers because of the position it occupies in the sentence. The pronominal it in the second passage functions in a similar manner. Cohesion is achieved not by the pronominal alone, nor is it effected by the item being referred to. What binds the text together is the relationship between the two. This relationship seems to lie on the borderline between two types of cohesive ties: reference and substitution.

Besides pronominals, there are other kinds of anaphoric relations such as proverbs and ellipses. Of these, pronominals have the highest frequency of occurrence in the language. It is indeed difficult to read a few lines of text without coming across this linguistic feature. Despite the frequency of occurrence of anaphora, this linguistic phenomenon is little studied and poorly understood. Menzel (1970) explained that "one reason for our ignorance in this area is that anaphora is partly syntactic and partly semantic, so that grammarians feel that any solution of the problem must await a systematization of semantics, which today is far from being realized" (p. 97). Although our understanding of semantics is still far from complete at this time, recent advances in text linguistics and text comprehension (van Dijk, 1977; Kintsch and van Dijk, 1978; Meyer, 1975, 1977; Norman and Rumelhart, 1975) and computer-based models in handling anaphora (Burton, 1976; Levin, 1976; Rieger, 1974; Rosenberg, 1976; Wilks, 1975; and Winograd, 1972) have generated much interest in this area. In the following section, I will review some current attempts in studying anaphora. It is hoped that this survey will bring some kind of structure to the bits and pieces of

observation which scatter through the literature in linguistics and psychology.

Anaphoric Relations : An Overview

Although repeated attempts were made in linguistics to further our understanding of the theoretical basis upon which pronouns, or more precisely, pronominals were to be analyzed (Jespersen, 1909-1949; Kruisinga, 1932; Poutsma, 1904-1926; and Sweet, 1891 & 1898/1955, & 1958), the real breakthrough did not come about until Bloomfield (1933) introduced the notion of substitution. Bloomfield (1933) defined a substitute as "a linguistic form or grammatical feature which, under certain conventional circumstances, replaces anyone of a class of linguistic forms" (p. 247). According to Bloomfield, a pronominal is an anaphoric substitute in that it is dependent on its antecedent for meaning. Bloomfield commented that despite this reliance on prior information, pronominals work more accurately than noun forms since they refine the specific meaning of the noun forms which they replace. For example, who and what subdivide English substantive expressions into animate and inanimate, and he and she further divide the animate substantives into masculine and feminine. Bloomfield's theory emphasizes the utility of substitutes in promoting accuracy and clarity as well as economy in language use.

Bloomfield's postulation has delineated two important aspects of pronominalization. One is the replacement function of a pronominal and the other is its function in redefining the meaning of the noun form it replaces. Both Allen (1961) and Crymes (1968) supported Bloomfield's use of the term "replace" in defining a substitute.

They argued that in pronominalization, although a pronominal refers to an antecedent for its meaning, it actually replaces a non-present construction which could occur in the position occupied by the pronominal in the sentence. A pronominal therefore has a referential and a substitution function. The former signifies a semantic relationship between the pronominal and what is being referred to. The latter signifies a syntactic correlation within the text. Crymes (1968) extended her investigation of anaphoric relations beyond the pronominals. Her findings confirmed Bloomfield's position that substitutes signal meaning which the replaced constructions do not. Givón (1976) furthered this linguistic postulation by proposing that the pronominal system in a text represents the reduced semantic form of its nominal system. All the pronominal agreement features which characterize the nominal universe in the lexicon, such as plurality, gender, and animateness, represent only the more general features which underlie this universe. Since pronominals are used in contexts where their antecedents have already been mentioned, it is redundant and wasteful to be more specific than to describe the general properties of the referent nominal. In a given discourse context, the more specific characterization of the coreferent nominal should be easily recoverable.

The question as to the ease that readers have in doing this act of referencing has been investigated in several studies (Bormuth, Manning, Carr and Pearson; 1970; Chai, 1967; Lesgold, 1972, 1974; and Richek, 1976-77). These studies yielded variant results, depending on the anaphoric relations examined and the measure of comprehension used. However, one finding which is common to all is that

intermediate grade students appear to have difficulty in identifying the antecedents for various anaphoric substitutes, a skill which is assumed to have been mastered early in life. There are great variations among subjects and among anaphoric relations in terms of performance. The feasibility of viewing anaphoric relations as an ordered set of hierarchical skills is therefore questionable.

In explaining the results of these studies, Lesgold (1974) argued that grammatical rules for nine-year-olds are not abstract structures that apply mechanically but that they are inextricably bound with semantics. Children at that age may know the grammatical rules but they may not know the interpretive rules required to understand the structure in a particular semantic context. Lesgold further pointed out that because children's memory span is limited, they may not be able to process units of information which are long and therefore, the extent to which a given item exceeds or stays within the children's capacity may be a determinative factor in their performance. The length of an antecedent may present varying degrees of difficulty for children as far as identification is concerned. Lesgold's position is supported by Richek's (1976-77) study. She found her subjects comprehended the best when the noun forms instead of the substitutes were used. She explained that the amount of information immediately available to the reader can be an important factor in reading comprehension. These postulations lead us to the notion of consciousness (Chafe, 1974, 1976). Chafe claims that only entities which the language producer assumes to be in the consciousness of the language processor can be referred to pronominally. The stretch of text which separates a substitute

from its antecedent may perhaps signal the availability and accessibility of information for referencing purposes.

According to the literature reviewed, the following conclusions can tentatively be drawn.

1. Linguistic studies have postulated that anaphoric substitutes are linguistic forms which replace other linguistic constructions.
2. Anaphoric relations promote cohesion in a text through reference and substitution. Reference functions on the semantic level and its cohesion lies in the semantic identity between an anaphor and its referent. Substitution, on the other hand, functions on the grammatical level and its cohesion lies in the syntactic correlation between an antecedent and its substitute within a text. The question as to which kind of cohesive relation is a factor in comprehension is still undetermined.
3. Pronominalization, the most frequently occurring anaphoric relation, is considered to be a means of promoting clarity and economy in language use. It is assumed that the meaning represented by the pronominals can be recovered when needed.
4. Psychological studies do not seem to support the linguistic postulations advanced so far. Children have been found to have difficulty in comprehending anaphoric relations.
5. The bulk of experimentation on anaphoric relations has been carried out using sentences in isolation. Whether these findings will hold up with longer stretches of text still needs to be determined.

6. All anaphoric substitution studies in reading deal with single word substitution. No attempt has yet been made to examine the effects of substitutes which replace different construction-types or refer to more complex antecedents on reading comprehension.
7. Findings from these studies seem to suggest that the amount of information carried by a substitute and the distance between an antecedent and its substitute can pose difficulties to the reader in comprehending anaphoric relations.

The conceptual framework as delineated above guided much of my own thinking in conducting the following study on anaphora. The purpose of the study was to examine the relationship between anaphoric nominal substitution and reading comprehension. Specifically, two theoretical questions were formulated:

1. Is there a relationship between readers' ability to reproduce constructions which are replaced by anaphoric nominal substitutes in discourse and the readers' reading comprehension?
2. Which of the following variables, or combinations of variables, is the best predictor of item difficulty in anaphoric nominal substitution?
   a. A change in the grammatical form of the antecedent when the construction is reproduced in the position occupied by the substitute.
   b. A discrepancy between the position of the substitute on one layer of a sentence and the position of its antecedent on another layer in the same (or a different) sentence.
   c. The distance between the substitute and its antecedent.
   d. The length of the construction replaced by the substitute.

The Study

Method

The subjects for the study came from two populations. One sample was composed of juniors, seniors, and graduate students enrolled in a teacher certification course. The second sample consisted of college freshmen who had sought assistance in improving their reading skills. Altogether, 172 subjects were tested, 80 belonging to the first sample and 92 to the second.

Reading scores of the subjects were obtained by applying the Diagnostic Reading Tests : Upper Level, Survey Section. Total Substitution Scores were collected by administering the Substitution Test. The test was made up of two continuous texts. Seventy-nine instances of anaphoric nominal substitution were identified and subjects were asked to write down what they thought had been replaced by the substitute in each instance. The responses were scored according to semantic and syntactic appropriateness. Thirty sets of protocols from each sample were scored independently by a second judge.

Results

Positive and significant relationships were found between Total Substitution Scores and Reading Scores for both samples, the highest being that between Total Substitution and Reading Comprehension in the combined sample ($r = .78$). These correlation indices are summarized in Table 1.

Insert Table 1 about here

Approximately 59% of the variance on Reading Comprehension was accounted for by the readers' ability to reproduce the constructions replaced by the substitutes in the Substitution Test.

Using four item characteristics, namely, Change, Discrepancy, Distance, and Length as independent variables and Item Mean as the dependent variable, Length was consistently the best predictor of item difficulty, yielding a correlation of -.51 across the samples. When the stepwise multiple regression procedure was employed, Length and Distance combined were the best predictor of item difficulty, accounting for approximately 36% of the variance in the subjects' responses. Tables 2 and 3 summarize the data for these analyses.

Insert Tables 2 & 3 about here

What needs to be mentioned is that the statistical indices obtained were almost identical regardless of whether the analysis was done on the subjects in the first sample, the second sample, or the two combined.

Discussion

This study has yielded four important findings in relation to anaphoric relations. First, the ability to figure out what is replaced by a substitute is a factor in reading comprehension in that it explains approximately 59% of the variance on readers' performance. Second, the process of antecedent-substitute resolution is not a simple matter of recovering the information from the context as suggested by the linguists (Bloomfield, 1933; Givón, 1976). This process may indeed involve sophisticated syntactic, semantic, inferential, and evaluative skills. Third, difficulty in handling anaphoric

relations is not restricted to children alone. The performance of the college students in this study points to Flavell's (1977) production-mediation deficiency hypothesis. Some may not have used the strategy because they are unaware of it. Others may have knowledge of the strategy but not the skill to apply it without assistance. Fourth, of the four item characteristics investigated, the syntactic variables (Change and Discrepancy) were not as powerful as the semantic variables (Length and Distance) in explaining item difficulty. Although anaphoric relations are in some sense governed by grammatical constraints since they are realized through sentences, such constraints may become insignificant when the relationship between the antecedent and its substitute extends beyond sentence boundaries as is often the case in continuous text. This line of thinking seems to point to the possibility that semantic considerations may be more crucial than grammatical relations to an understanding of discourse structure. If further research were to yield similar results, it would then be appropriate to hypothesize that reference rather than substitution is a factor in comprehension.

The semantic variables, Length and Distance, were the best combined predictor of item difficulty. While the antecedents found in a text do serve the function of suggesting the referents for anaphors, efficient reading seems to depend on the amount of information immediately available to a reader as he reads. The distance between an antecedent and its substitute in a text can be interpreted as a semantic tie between the two. The antecedent, acting as the referent, determines how far back the reader has to go in order to recover the meaning of the substitute from its linguistic context. The negative

correlation between Distance and Item Mean suggests that the farther away the antecedent, the more difficult the item. This phenomenon may perhaps be related to the information processing apparatus in operation in our memory system (Kintsch, 1974, 1976). As a text is processed, information is either being hooked onto the emerging semantic network in long-term storage, or is being erased as new information enters the short-term storage. An antecedent which lies far away from its substitute may not still be present in the working memory of the reader as the substitute is read, and therefore what is being referred to may not be available for immediate retrieval at the time when its meaning is called for. What a reader may have to do is to backtrack over sizeable stretches of text to locate the antecedent so as to determine the meaning embodied by the substitute. This behavior of backtracking, such as in the form of regressive eye movement or turning the pages backwards, may indeed signal a parallel process of mental search. When the needed information cannot be re-instated to supply the missing links, comprehension is brought to a halt.

Length was the best single predictor of item difficulty. The negative correlation between Length and Item Mean indicated that the longer the construction replaced by the substitute, the more difficult the item. In the present study, the length of a construction was measured in terms of the number of words used. The assumption was that the longer constructions contain more information than the shorter ones. Although one might indeed recognize that using this procedure to measure information load is at best inadequate, one can still see that the amount of information represented by a substitute is a factor in comprehending anaphoric relations. This

difficulty in processing substitutes which carry a high information load may be related to the way our memory system works (Chafe, 1974, 1976; Lesgold, 1974) in like manner as the Distance factor is. But it is also possible that the subjects were simply unaware of the capacity of these nominal substitutes. With the common notion of a pronoun being a word that "takes the place of a noun", the second speculation does not seem implausible.

In a society where knowledge is acquired mainly via written prose, one important goal of education is to help students develop more efficient strategies in acquiring information from their reading. Educators have long recognize that reading comprehension involves "the ability to follow the organization of a passage and to identify antecedents and find references in the passages" (Davis, 1941, p. 23). The literature reviewed and this study all lend support to this observation. If a reader does not recognize a substitute as anaphoric, or if he is unable to determine the meaning necessary for its interpretation in a given linguistic context, the likelihood of his being able to make sense of what he is reading is slim. Some samples of responses from the not-so-fluent readers in the study may help illustrate this point. These responses can best be discussed by reproducing them as they appeared in their respective text segments. They are presented in Figures 1 and 2.

Insert Figures 1 & 2 about here

These responses suggested that these readers' perception of linguistic units was a function of the physical layout of the text. While it

may be premature to conclude that they are insensitive to the semantic as well as syntactic signals in written English, this line of reasoning warrants further investigation, since its implications are considerable, both theoretically and practically.

Another difficulty that these readers have in handling anaphoric relations is presented in Figure 3.

Insert Figure 3 about here

They were able to locate the antecedents but were unable to pinpoint the entities that were being referred to. When taken to the extreme, this failure in referent resolution can result in a total loss of comprehension.

Anaphoric Relations, Readability and Comprehensibility of Text

Based on the observations delineated in this paper, a systematic analysis of anaphoric relations is likely to shed light on our understanding of aspects of text comprehension. Conversely, any model of text comprehension is incomplete if anaphoric relations are not accounted for. In order to understand the role of anaphoric relations in this context, an examination of this cohesive device in relation to readability research and text comprehension is necessary.

For many years, the word "readability" has been almost exclusively associated with assessing reading levels of tests and instructional materials for school children. As a result, the idea of communicative efficiency in prose is often alienated from any discussion of readability. In theory, the major purpose of readability

research is to ascertain those factors which affect one's comprehension of the written language with the hope that the factors so identified can be incorporated into a theory of the way people read and understand text (Klare, 1963, 1974-75). In practice, however, constant effort has been directed to the development of faster, easier, more reliable, and more valid procedures for readability assessment (MacDonald-Ross, 1979). These procedures have generally incorporated sentence length (in terms of the number of words per sentence), and vocabulary load (in terms of frequency of occurrence or polysyllabic count) into a formula for easy application. This discrepancy between what these formulas are supposed to do and what they are equipped to do has resulted in great confusion and a number of unfortunate practices.

First, readability formulas are often used as the sole measure of reading levels of text materials, resulting in serious mismatches between the reader and the text (Bormuth, 1966). Second, these formulas are often called upon to perform functions beyond what they are intended for. Users of these formulas are seldom aware of the fact that the formulas are designed to estimate reading levels on the basis of sentence length and vocabulary load, but they are not equipped to predict how difficult or easy a particular reader or a well-defined class of readers will find a piece of writing. Third, text features, such as cohesion, subject content, content structure, and other aspects of readability pertaining to the physical layout of a text are rarely, if ever, taken into consideration in such assessment. These practices have further compounded the already

existing confusion between readability, which is text-based, and the level of reading ease, which is reader-based. The reading level designation yielded by a particular formula implies no more or less than what is being fed into the formula to obtain such a measure. To stretch the predictive power of such a designation beyond its limits as imposed by the input data is certainly inappropriate.

If our purpose in estimating reading levels is to lessen the mismatch between the reader and the materials to be read so as to enhance the acquisition of knowledge through the written language, what is needed is not an index of the readability of a piece of writing, but an index of its comprehensibility in reference to a specific reader or a well-defined class of readers. The concept of the comprehensibility of text differs from that of readability in that comprehensibility encompasses more than just what is in the text itself. The degree to which a reader will find a text comprehensible is dependent upon the interaction of three sets of variables, namely, reader's assets, text features, and pragmatic factors. The conceptual framework of the comprehensibility of text is schematically represented in Figure 4.

Insert Figure 4 about here

While it is beyond the scope of this paper to discuss this conceptual framework in full, one can at least see how anaphoric relations are related to readability and comprehension. In order to comprehend a piece of writing, the reader has to apply his affective, cognitive, and language abilities. Such applications are facilitated if the text features and the pragmatic factors are supportive of these

activities. When one of these variables is imposing demands on the reader beyond what he can possibly compensate for, comprehension is likely to be drastically reduced.

Anaphoric relations, together with a wide variety of linguistic devices, are tools which are available for a writer to use. If the writer's selection of linguistic tools is guided by communicative justification, the probability that the reader will find the resultant text comprehensible is higher. As a system of meaning representation, anaphoric relations exist in every piece of writing and their potential for creating barriers in comprehension cannot therefore be ignored. As a cohesive device, these relations have the capacity to provide linkages for transference of meaning between the reader and the text as well as between segments within the text. In narrative writing, substitute words can be called upon to transfer names of people and places, and in expository writing, they can be extended to convey lengthy concepts and ideas. But the key to efficient comprehension may not just be a matter of being aware of how this device can be used in writing. The key may well lie in the ability to apply this strategy to meet all kinds of demands in language processing, even if the text appears to be incomprehensible at the time. Knowing that current readability assessment do not incorporate anaphoric relations as a factor, people who are involved with any aspects of textual literacy may find the content of this paper helpful in evaluating and selecting materials for their users.

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Table 1

Pearson Product-Moment Correlations between Reading Scores and Total Substitution Scores for the Combined Sample

Reading Scores	Total Substitution Scores
Total Reading	.77*
Reading Comprehension	.78*
Reading Vocabulary	.68*

* $p < .01$.

Table 2

Pearson Product-Moment Correlations between Item Characteristics for the Combined Sample

	Change	Discrepancy	Distance	Length
Item Mean	-.32*	-.27*	-.44*	-.51*
Change		.35*	.15	.10
Discrepancy			.21	.17
Distance				.17

*$p < .01$. N of items = 79

Table 3

Multiple Regression Data for Item Characteristics and Item Means For the Combined Sample

	Multiple R	F
Length	.51	26.64*
Length, Distance	.62	24.11*
Length, Distance, Change	.66	19.31*
Length, Distance, Change, Discrepancy	.66	14.41*

* $p < .01$. N of items = 79

LEFT		RIGHT	
1	Over three and a half centuries ago	1	
2	Sir Francis Bacon, a brilliant but	2	
3	unscrupulous statesman in the court of	3	
4	King James, let his nimble mind wander	4	King James, let *King James'* nimble mind wander
5	through a great number of subjects. So wide	5	

Figure 1: An example of subjects' response indicating a reliance on the physical layout of the text in anaphor-resolution.

LEFT		RIGHT	
78	than every word. Knowing when and how to	78	
79	do these things will give you a greater	79	do _____ will give you a greater
80	understanding of general informational	80	
81	material, a greater appreciation of	81	
82	literature and a greater speed in reading	82	*understanding of general informational material, a greater appreciation of literature and a*
83	both.	83	*greater speed in reading* _____.

Figure 2 : An example of subjects' response indicating a reliance on the physical layout of the text in anaphor-resolution.

LEFT	RIGHT
90 conclusion. The nature of the material may	90
91 determine whether you mainly study it for	91 determine whether you mainly study the nature of the material for
92 details, analyze it to get the author's	92 details, analyze the nature of the material to get the author's
93 main ideas, or examine it critically to	93 main ideas, or examine the nature of the material critically to
94 draw your own inferences. Materials to be	94

Figure 3: An example of subjects' responses indicating difficulty in anaphor-resolution.

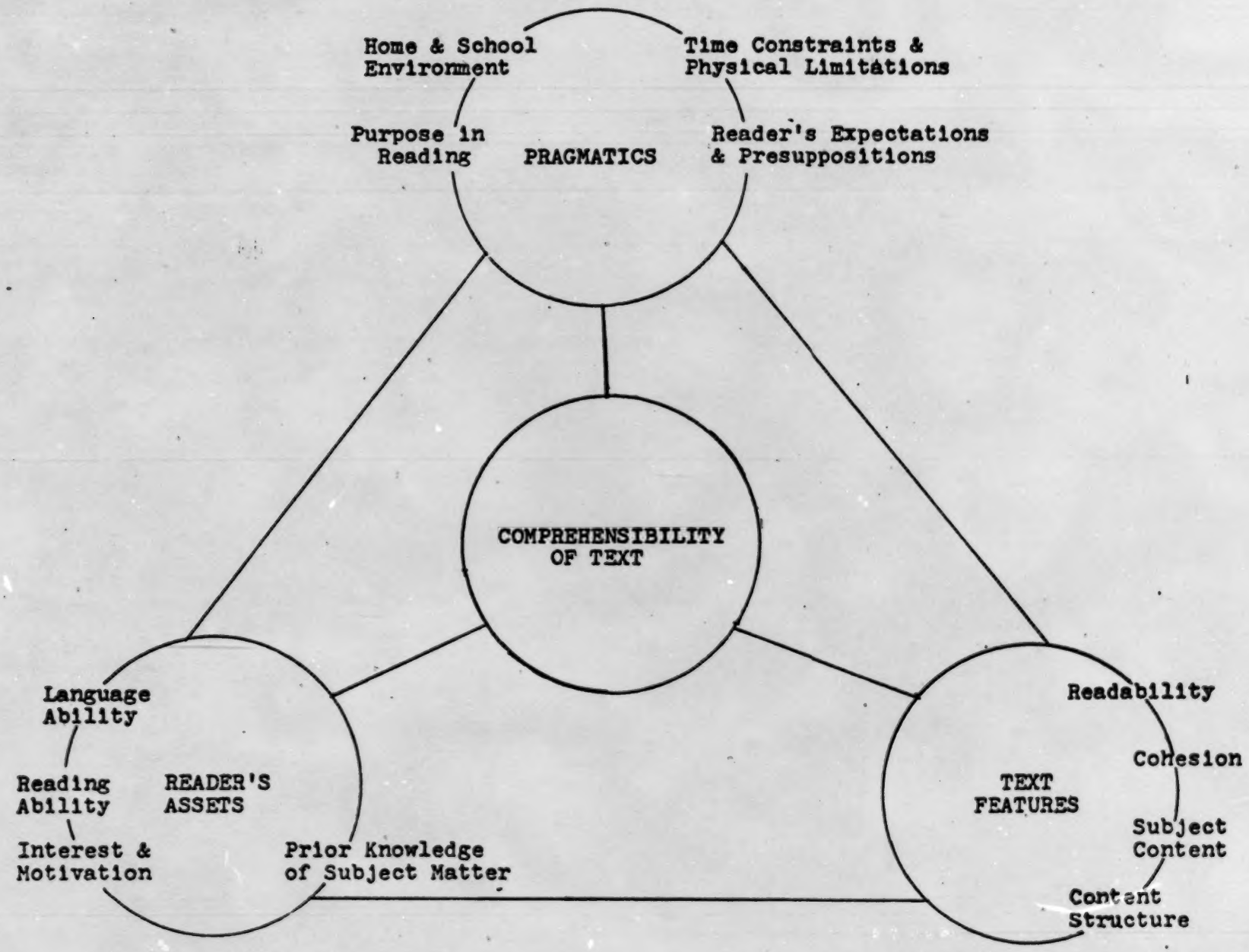

Figure 4: A schematic representation of the comprehensibility of text.